/D/O/L/D/

Operating Instructions	DMP 96 A

Single-channel controller   Two-point controller
Continuous-action controller
with one limit-value contact

Program versions:	**020H0**	**020H3**	**020H6**
	020H1	**020H4**	**020H7**
	020H2	**020H5**	**020H8**
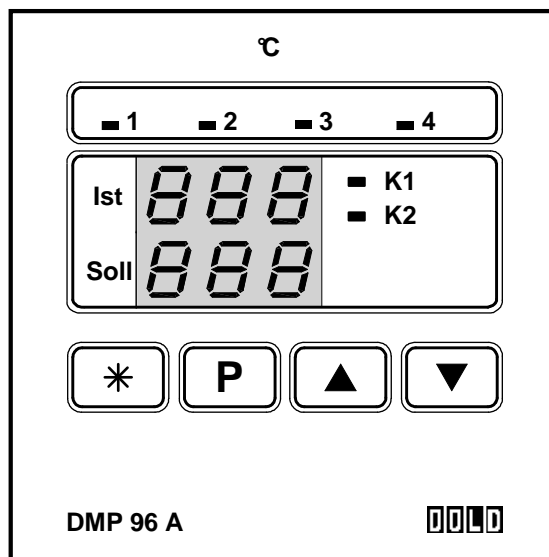
**Before connecting the regulator it is essential to read
this Manual and follow it's instructions.**

(Subject to technical changes)

Contents

1. Installing the controller:

1.1 Directions for installation

Important: These directions for the installation of DOLD devices have to be adhered to:

If these directions are not adhered to the device may not work accurately, be destroyed or it may result in data being lost.

Read all directions carefully before connecting the device.

Connection to be carried out only by experts.

This device is not a safety device. Safety devices have to be installed according to the relevant directions for use.

Check if the power-supply voltage corresponds to rated voltage indicated on the identification plate before connecting and putting the device into operation. Fluctuations in the main voltage are only admissible within the indicated limits (specifications/identification plate).

The described device is designated for the installation of switchboards.

Electrical connections are to be carried out according to the connecting plan and the directions of the local electric supply company or the relevant regulations of the VDE respectively.

Other consumers must not be connected to the mains terminals.

In the event of mains interruptions, which lead to a malfunctioning of the device, relevant measures must be taken to avoid interruptions or interruptions must be filtered out by an external hum eliminator. The device is equipped with an internal hum eliminator.

On installation the sensor lines have to be shielded. The screen must be single-ended. With regard to thermoelement pick-ups the compensating lead has to be laid as far as the control terminals. The device and inductive consumers as well as sensor lines/signal lines and high tension lines have to be placed in such a way that any mutual interference is excluded (placed separately; not parallely laid). go-and-return lines should be laid parallely and, if possible, twisted.

Non-insulated sensors of a multi-channel control have to be adjusted to the same potential (max. potential difference: $\pm$ 3.5 V eff.). Otherwise insulated sensors must be used (Warning: Ceramics insulations (Al-Oxide) can be conducting $\geq$400 ℃).

Post-connected contactors have to be equipped with RC protective allocations according to the manufacturer's instructions. If an internal protective allocation is mentioned in the connection plan of the device this has to be taken into account in the event of external allocation. If external allocation is missing short-term voltage peaks may result which lead to faster contact wear and may cause interference.

The preadjustment of all parameters has to be checked during operation and adjusted to the local conditions (installation)! Wrongly adjusted parameters may cause serious malfunctions!

Not all controlled systems can be controlled by parameters measured by means of self-optimising; therefore, on principle, control response is to be checked for stability.

The load circuits of the relays have to be protected against excessive currents in order to avoid the relay contacts becoming welded together.

The device must not be installed in an ex-area.

If used for purposes other than originally intended the device may be damaged and cause damage to connected installations.

The life time of the relays is limited to 10^6 switching cycles at a load of 500 VA. Thus it is to a high degree dependent on the frequency of switching cycles.

Time per switching cycle	Time after which 10^6 switching cycles are reached (operation: 8 hours/day at a load of 500 VA)
120 s	about 11.4 years
60 s	about 5.7 years
30 s	about 2.8 years
This table is invalid for Solid-State-Relay.	

At low loads life time increases with regard to the values indicated in the table.

The device is to be protected against moisture (especially condensing moisture) and excessive contamination. If this is not assured the device is liable to malfunctions.

Unplug connecting plugs only longitudinally to plug direction. Under no circumstances must the connecting plugs be plugged in or out obliquely!

Furthermore care must be taken that the surrounding temperature corresponds to the values shown in the specifications. Sufficient air circulation must be provided.

These operating instructions do not contain all directions to regulations, standards etc. which become effective when using this device in connection with other installations. These regulations, standards etc. must be ascertained and abided to by the purchaser.

1.2 Identification plate:

The following information is important and should be given whenever you have any technical questions:

● *Type of controller*
  Factory number
  Program version
  Model number

● *DMP 96 A*   ASP 675XXX   Type of controller
   Operating voltage: XXX V +/-10%   Terminal connection diagram number
   Switching capacity: 500 VA at 230 V AC   as per order

● *Factory number:*   XXXXXX FXXPXXHXX
   Input: XXXXX   as per order
   Logic input: configurable function
   Outputs: relay   as per order
                 Logic outputs

● *Program version:*   XXXXX
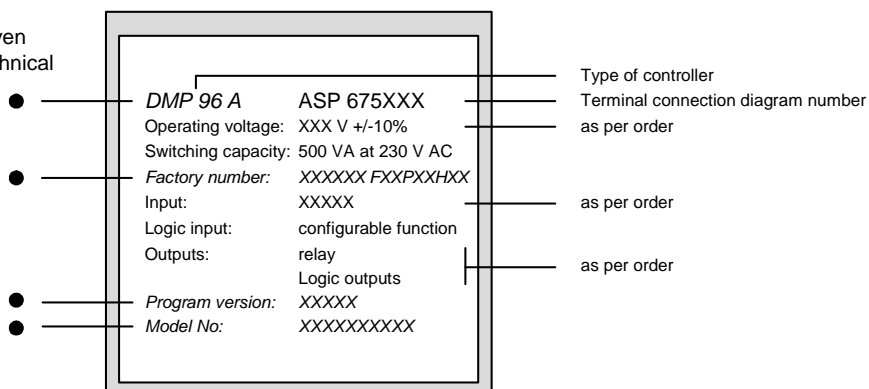● *Model No:*   XXXXXXXXXX

Figure 1: DMP 96 A identification plate

1.3   Connecting the controller:

1.3.1   Auxiliary power:

Auxiliary power (operating voltage) as per identification plate:

Standard: 230 V AC (±10%), 48...62 Hz,
Power consumption, depending on model: ≤ 6 VA,
Not affected by voltage fluctuations within the defined rangeTerminal connection diagram:

1.3.2   Terminal connection diagram:

This connection diagram shows maximum terminal assignment for the controller when all con-
nection possibilities are used. The appropriate terminal assignment (depending of the type of
controller used) can be found in the accompanying connection diagram.

Connection diagram number according to identification plate: ASP 675XXX
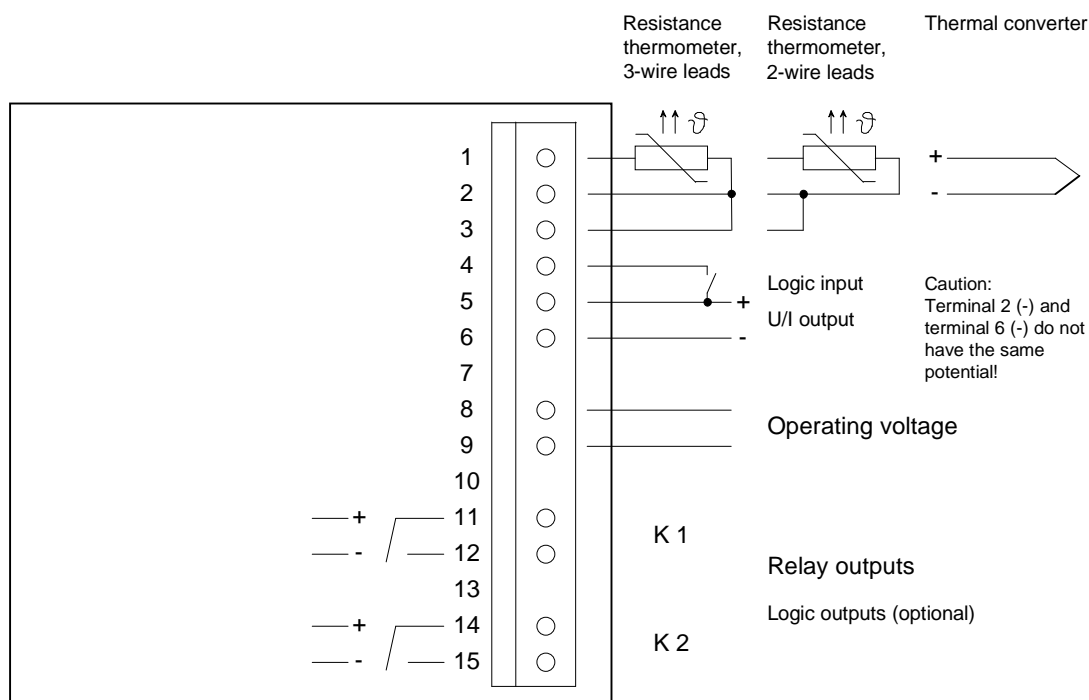
Figure 2: DMP 96 A connection diagram

1.4   Mechanical Data:

Protection class: VDE 0631
Insulation group: C as per DIN VDE 0110 b
Type of protection: As per DIN VDE 0470 (replaces DIN 40 050)
                             EN 60 529 / IEC 529
                             Front panel: IP 50 (optionally: IP 54 with the proper mounting
                                                        and a suitable sealing ring)
                             Housing: IP 30
                                             IP 20

Housing:	Pull-out housing for mounting control panel per DIN 43 700 with a B fastener as per DIN 43 835 (M 4 screw clamp)
Material:	PPO, glass-fiber reinforced (Noryl GFN2SE1) self-extinguishing, non-dripping fire protection class UL 94 V1
Front panel dimensions:	96 x 96 mm DIN 43 700
Control panel cutout:	$92^{+0.8}$ x $92^{+0.8}$ mm
Recess depth:	approx. 92 mm including screwed plug connector
Terminal connections:	Screwed socket strips nominal cross section 2.5 mm^2
Weight:	approx. 500 g
Ambient conditions:	Operating temperature range: 0...+50℃ Storage temperature range: -30...+70℃ Climatic utilization category: as per DIN 40 040, corresponding to 75% relative humidity without moisture condensation.

2.   Technical data, inputs:

2.1   Analog inputs:

Input as per identification plate or sensor ID:

- Pt 100 three-wire lead
- Fe-CuNi thermal converter, Type L
- Ni Cr-Ni thermal converter, Type K.

Sensor ID:

Sensor:	Sensor ID:	ID according to ordering key:	Max. display range:	Max. setpoint range:	Program version:
Pt 100	P 1	P 1	-69...149℃	-50...100℃	020H0
Pt 100	P 2	P 2	-69...249℃	-50...200℃	020H1
Pt 100	P 3	P 3	-69...349℃	-50...300℃	020H2
Pt 100	P 4	P 4	-69...699℃	-50...600℃	020H3
Pt 100	P 5	P 5	-169...149℃	-150...100℃	020H4
Fe-CuNi Type L	tL1	L 1	-24...499℃	0...450℃	020H5
Fe-CuNi Type L	tL2	L 2	-24...899℃	0...850℃	020H6
Ni Cr-Ni Type K	tn1	K 1	-24...649℃	0...600℃	020H7
Ni Cr-Ni Type K	tn2	K 2	-24...1299℃	0...1200℃	020H8

(See Information Level, Section 8.7, for instructions on querying sensor ID).

2.1.1 Technical Data, inputs:

Pt 100:	Sensor current: constant 1 mA DC
	Calibration precision: ≤ 0,15 % F.S.
	Linearity error: ≤ 0,1% F.S.
	Temperature drift characteristics: ≤ 100 ppm/K
	Equipped with sensor breakage cutoff and short circuit fuse

| Pt 100 three-wire lead: | Automatic line resistance compensation via software (maximum permissible line resistance: 50 Ω per lead) |
| Pt 100 two-wire lead: | Line resistance correction (line compensation) of max. 9 Ω possible via software (external bridge clamps 2-3), |

Thermal converter:	Calibration precision:	≤ 0.15% F.S.
	Linearity error:	≤ 0.15% F.S.
	Temperature drift characteristics (without reference point compensation):	≤ 80 ppm/K
	Effect of line resistance:	≤ 2µV/Ω
	Reference point compensation	
	Error recognition using a controller reference point > 70°C	
	Sensor breakage cutoff	

General:	Measurement cycle:	1 s
	Resolution:	≥ 12 bit
	LRC and diode protection circuit for each input	
	Measuring-circuit monitoring:	Error shown on display
	Protective circuits:	Hardware watchdog and power-fail
	Data backup:	EE-PROM, semiconductor storage, Hardware-protected calibrated values

2.1.2 Error-handling at input:

If the input signal leaves the maximum display range (for sensor ID) this is recognized as an error, evaluated, and shown on the display (error message "Er 1"). See section 4.4, page 11.

2.2 Digital inputs:

Logic input via potential-free contact, with configurable function

Contact: / Function:	Contact open	Contact closed
Setpoint switchover	Enter value for setpoint 1	Enter value for setpoint 2
Stop function	-	Control contact K 1 deactivated
Programming block	Programming function block	Programming function release

3. Control response:

3.1 Controller function:

Control response is configurable:

- Two-point response for heating or cooling, with adjustable hysteresis
- Two-point response for heating or cooling with PDPID – control characteristic and self-optimization algorithm

- Continuous-action control response for heating and cooling with PDPID – control characteristic and self-optimization algorithm
- Three-point response with adjustable hysteresis
- Three-point response with one-sided PDPID – control characteristic and self-optimization algorithm

3.1.1 Two-point controller:

Relay output K 1:   Switching function configurable: Control contact or limit comparator
Relay output K 2:   Switching function configurable: Limit-value contact (with adjustable hysteresis) and limit comparator

Options: Logic output in place of relay output K 1 or K 2, actual-value output.

3.1.2 Continuous-action controller:

Output 1:   Characteristic curve configurable (heating or cooling): Control output (relay output K 1 eliminated)
Relay output K 2:   Switching function configurable: Limit-value contact (with adjustable hysteresis) or limit comparator

Option: Logic output in place of relay output K 2

3.1.3 Three-point response:

Three-point response is configurable:

Relay output K 1 heating, relay output K 2 cooling,
Relay output K 1 cooling, relay output K 2 heating,

Options: Logic output in place of relay output K 1 or K 2, actual-value output.

3.2 Actuator function:

Reconfiguration of the "Aut" parameter makes it possible to use the unit as an actuator (actuator mode: parameter "Aut" set to OFF on the configuration level)

The ☀ key can be used to switch smoothly back and forth between the controller functions (automatic function) and the actuator (manual function).

The manipulated variable (%) set on the operator or setpoint entry level is relative to the cycle time (with relay output) or to output deviation (with continuous-action output).

The currently activated function is stored in the EE-PROM. When the unit is powered up it is in the state of the function last stored.

Display:

Display: Function:	Upper 7-segment display	Lower 7-segment display
Controller	current actual value	setpoint
Actuator	current actual value	alternation between " -y- " / manipulated variable

4.   Outputs:

Outputs as per identification plate and accompanying terminal connection diagram:

4.1   Potential-free relay contacts, make contact:

Contact load: $\leq$ 250 V AC, $\leq$ 8 A resistive load
                              at 500 VA typically 10^6 switching cycles

4.2   Logic output (optional):

Logic outputs for activating solid-state relays,
(in place of relay outputs K 1 or K 2):
Open collector, not galvanically separated, short-circuit-proof,
typically: 0/10 V DC, maximum: 20 mA.

4.3   Analog output:

Analog output as per order and identification plate

Two-point controller: actual-value output (optional):   range limits configurable
Continuous-
action controller: Control output: characteristic curve (heating or cooling) configurable

Current output: output value configurable: 0...20 mA
                                                                                              4...20 mA

Voltage output: output value as per order: 0...1 V DC
                                                                                              0...2 V DC
                                                                                              0...5 V DC

4.3.1   Technical data, analog output:

Current and voltage output: resolution: 8 Bit
Current output: load: $\leq$ 250 Ω
Voltage output (short-circuit-proof):   internal resistance Ri: $\leq$ 250 Ω

Note: Any current output present but not needed must have a terminating resistor of $\leq$ 250 Ω
              or a bridge (terminals 5-6).

4.4 Output responses in cases of error:

Output response in cases of sensor error:

- Relay or logic outputs: Outputs assume the state defined on the configuration level.

- Analog output: (continuous-action controller, actual-value output):
  output U: 0...1 V DC, 0...2 V DC, 0...5 V DC: output signal: 0 V DC

  output I: 0...20 mA   output signal: 0 mA
  output I: 4...20 mA   output signal: 0 mA

Incorrect actual-value response due to sensor error or response exceeding the set range:
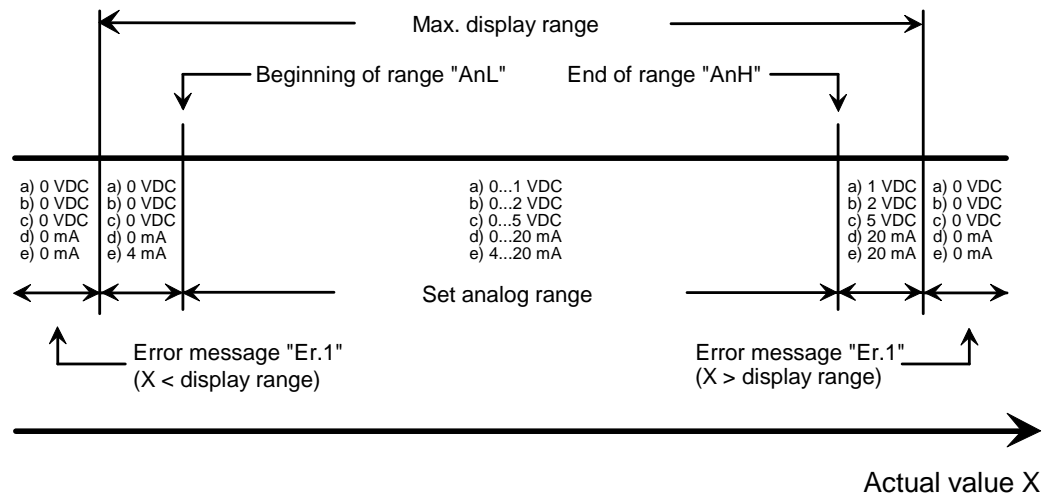
Figure 3: Actual-value response in cases of error

5.   Display:

- Actual-value and setpoint display: resolution adjustable
- Setpoint display: display range adjustable.

General information:

Powering up:
When power is turned on the following displays appear:
- On the upper 7-segment display: the parameter "P.nr".
- On the lower 7-segment display: the current program number "X.X".
After approx. 5 s the controller switches to normal operating mode.
Outputs are inactive during a cold start.

5.1 Upper 7-segment display

shows:

- the actual value
- parameter designation in entry mode

5.2 Lower 7-segment display

shows:

- setpoint
- parameter value in entry mode
- alternation between " -y- " / manipulated variable when actuator function is activated (manual function)
- alternation between setpoint (auxiliary setpoint) / "Opt" during the self-optimization procedure.

5.3 LED's:

LED:	K 1	yellow	lights up when output K 1 is active
LED:	K 2	yellow	lights up when output K 2 is active
LED:	1	green	lights up when continuous-action controller is functioning
LED:	2	green	lights up when logic input is activated (contact closed)

6. Explanations of symbols:

Display:	Meaning:
"P.nr"	Current program number
"SP.1"	Setpoint 1
"SP.2"	Setpoint 2
" -y- "	Manipulated actuator value
"Cod"	Code entry
"Con"	Enter configuration level
"Cor"	Line compensation or zero-point offset
"rA.H"	Set upper limit of setpoint range
"rA.L"	Set lower limit of setpoint range
"Co.1"	Configuration, relay contact K 1
"Co.2"	Configuration, relay contact K 2
"Fd.1"	fault on control output K 1
"Fd.2"	fault on control output K 2
"rES"	Display resolution
"Aut"	Configuration of automatic function
"Co.u"	Configuration of setpoint setting
"Co.A"	Configuration of analog input
"An.H"	Setting of upper measuring range limit for actual-value output
"An.L"	Setting of lower measuring range limit for actual-value output
"Co.L"	Configuration of logic input
"3-P"	Configuration of three-point response
"uSr"	Enter setpoint entry level
"PAr"	Enter parameterization level
"Pb.1"	Proportional band, control contact K 1
"ti.1"	Reset time, control contact K 1
"td.1"	Derivative action time, control contact K 1
"CY.1"	Cycle time, control contact K 1
"HY.1"	Switching hysteresis, control contact K 1
"bd.1"	Symmetrical. spreading, limit comparator K 1
"LA.2"	Absolute setpoint value, limit-value contact K 2
"Lr.2"	Relative setpoint value, limit-value contact K 2
"bd.2"	Symmetrical. spreading, limit comparator K 2
"HY.2"	Switching hysteresis, limit-value contact K 2

Display:	Meaning:
"noP"	Relay contact K 2 deactivated
"tun"	Enter self-optimization level
"HLP"	Correcting setpoint
"OPt"	Self-optimization activated
"inF"	Enter information level
"SEn"	Sensor ID
"Er.1"	Sensor error message
"Er.9"	System error message

7.   Operation:

The operating structure of the DMP 96 A controller includes six separate levels:

Setting the setpoint (depending on configuration):
- via the **operator level**.
- via the **setpoint entry level** (by entering a code).
- the **configuration level**, where line compensation, range limits, control functions, switching functions of the limit-value contact, and error allocations are defined.
- the **parameterization level**, which contains all parameters for adjusting the controller to the control loop.
- the **self-optimization level** for setting the correcting setpoint and for starting or aborting self-optimization.
- the **information leve**l for querying current program number and sensor ID.

7.1   Setting parameters on the various levels:

▲	current value:	**+1**
	after approx. 3 s:	**+10**
	after approx. 6 s:	**+100**

▼	current value:	**-1**
	after approx. 3 s:	**-10**
	after approx. 6 s:	**-100**

P	display value is accepted

The program returns to normal operating mode after the last parameter has been confirmed.

If no key is pressed within 20 seconds, the program automatically returns to normal operating mode without accepting any value that has been changed.

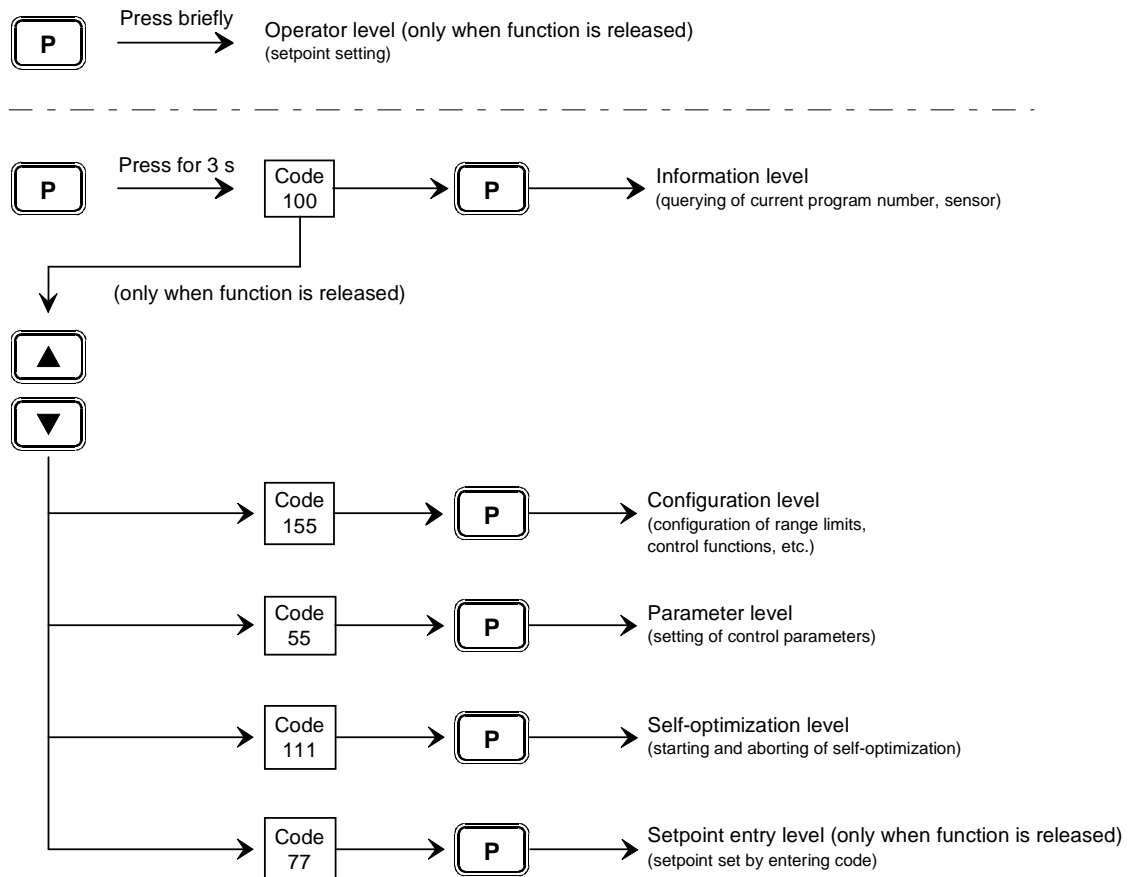| After confirming an incorrect code number:	Do not press any key for approx. 20 seconds. Wait for program to return to normal operating mode. Enter new code.

7.2   The various levels:

Figure 4: The various levels

7.3   Setting the setpoint:

How the setpoint is set depends on configuration (parameter "Co.u" on the configuration level). The setpoint can be set on the:

*   operator level (factory configuration)

*   setpoint entry level (setting made by entering a code number).

7.3.1   Setting the setpoint via the operator level:

  Press key briefly to jump to the operator level

Display:	Parameter:	Range:	Factory setting:
"SP.1"	Setpoint 1	"rA.L...rA.H"	0.0°C

Display:	Parameter:	Range:	Factory setting:
"SP.2"	Setpoint 2 (appears only for configuration "Co.L" = 01)	"rA.L...rA.H"	0.0℃
" y "	Setpoint manipulated variable (appears only for configuration "Aut" = OFF)	0.0...100%	0.0%

P   Display value is accepted

When configuring parameter "Co.u" = on (setting setpoint via setpoint entry level) it is not possible to jump to the operator level.

7.3.2 Setting the setpoint level via the setpoint entry level:

P   Press for approx. 3 s   to get display: **" Cod "**
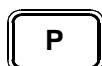
                                                                100

▲ **▼**   Enter code: **77**

P   Confirm code: Display: **" uSr "**

P   Jump to setpoint entry level.

Display:	Parameter:	Range:	Factory setting:
"SP.1"	Setpoint 1	"rA.L...rA.H"	0.0℃
"SP.2"	Setpoint 2 (appears only for configuration "Co.L" = 01)	"rA.L...rA.H"	0.0℃
" y "	Setpoint manipulated variable (appears only for configuration "Aut" = OFF)	0.0...100%	0.0%

P   Displayed value is accepted

When configuring parameter "Co.u" = OFF (setting setpoint via operator level) it is not possible to jump to the setpoint entry level.

7.4 The configuration level:

P   Press for approx. 3 s   to get display: **" Cod "**

                                                                100

▲ ▼	Enter code:		**155**

P	Confirm code:	Display:	**" Con "**

P	Jump to configuration level.

Display:	Parameter:	Range:	Factory setting:
"Cor"	Line compensation and zero-point offset	-25...25.0℃	0.0℃
"rA.H"	Set upper limit of setpoint range (end of setpoint range)	max. setpoint range by sensor ID (Section 2.1)	max. setpoint range by sensor ID (Section 2.1)
"rA.L"	Set lower limit of setpoint range (beginning of setpoint range) Note: With configuration "rA.H" = "rA.L" it is not possible to set the setpoint on the operator level. With configuration "rA.H" < "rA.L" the keys ▲ or ▼ can be used to switch back and forth between the set values	max. setpoint range by sensor ID (Section 2.1)	0.0℃
"Co.1"	Configuration of control output or limit comparator K 1 Two-point controller / three-point response: 01: Cooling controller with hysteresis setting towards plus 02: Cooling controller with PID feedback 03: Limit comparator closed in goodband (hysteresis fix at 0.5 K) 04: Heating controller with adjustable hysteresis towards minus 05: Heating controller with PID feedback 06: Limit comparator open in goodband (hysteresis fix at 0.5 K) Continuous-action controller: (parameter "Co.A" = 03 or 04, relay contact K 1 deactivated). 02: rising characteristic with PID "cooling" feedback 05: falling characteristic with PID "heating" feedback	01...06	05

Display:	Parameter:	Range:	Factory setting:
"Co.2"	Configuration of limit-value contact K 2 00: Relay deactivated (no function) 01: Absolute limit value of make contact relative to rising temperature 02: Limit value travels with setpoint, make contact relative to rising temp. 03: Limit comparator closed in goodband (hysteresis fix at 0.5 K) 04: Absolute limit value, break contact referenced to rising temperature 05: Limit value travels with setpoint, break contact relative to rising temp. 06: Limit comparator open in goodband (hysteresis fix at 0.5 K)	00...06	00
"Fd.1" "Fd.2"	Error allocation, outputs K 1; K 2 Output K 1 Output K 2 on: Output active in the event of error OFF: Output inactive in the event of error	on...OFF	OFF OFF
"rES"	Display resolution 00: resolution 0.1K 01: resolution 1K	00...01	00
"Aut"	Automatic function on: Automatic function mode activated (controller) OFF: Automatic function mode deactivated (actuator). The $\boxed{*}$ key can be used to switch from automatic function mode (controller) to manual function mode (actuator).	on...OFF	on
"Co.u"	Setting of setpoint via setpoint entry level on: Setting of setpoint via setpoint entry level activated OFF: Setting of setpoint via setpoint entry level deactivated (setpoint set via operator level).	on...OFF	OFF
"Co.A"	Analog output: Analog output of actual value (optional): 00: Analog output deactivated 01: Voltage/current output: 0...1 V DC, 0...2 V DC, 0...5 V DC or 0...20 mA 02: Current output: 4...20 mA Continuous-action controller: (parameter "Co.A" = 03 or 04), configure the desired control function (parameter "Co.1" = 02 or 05), (relay contact K 1 is deactivated): 03: Voltage/current output: 0...1 V DC, 0...2 V DC, 0...5 V DC or 0...20 mA 04: Current output: 4...20 mA	00...04	00

Display:	Parameter:	Range:	Factory setting:
"An.H"	Analog output of actual value High-end value of measuring range limit	max. display range dependent on sensor ID (Section 2.1)	end of set-point range dependent on sensor ID (Section 2.1)
"An.L"	Analog output of actual value Low-end value of measuring range limit	max. display range dependent on sensor ID (Section 2.1)	0.0°C

"Co.L"	Configuration of logic input
	00: Logic input deactivated
	01: Changing setpoint selection
	     contact open: setpoint 1
	     contact closed: setpoint 2
	02: Stop function
	     (not in effect with continuous-action
	     control output!)
	     Contact closed:
	     control contact K 1 deactivated and
	     setpoint display goes dark
	     (lower display)
	03: Programming block
	     Contact closed:
	     programming function released
	     Contact open:
	     programming function blocked
	     (jump to configuration, parame-
	terization, setpoint entry and self-opti-
	mization levels blocked).
		00...03	00

"3-P"	Three-point response
	on: Three-point response activated
	OFF: Three-point response deactivated
	
	Configuring three-point response
	e.g.: heating K 1: "Co.1" = 04 or 05,
	           cooling K 2: "Co.2" = 02
	
	           cooling K 1: "Co.1" = 01 or 02,
	           heating K 2: "Co.2" = 05
	
	           spreading (parameter "Lr.2") toward
	           plus or setting towards minus.
		on...OFF	OFF

Important: After any change of configuration or reconfiguration of outputs K 1 and K 2 (parameters "Co.1" and "Co.2") the corresponding parameters on the parameterization must be set and adapted to the directly controlled member.

After any change of configuration or reconfiguration of the setpoint range (parameters "rA.H" and "rA.L") the setpoint settings on the operator level, and the setpoint entry level must be checked and adapted to the setpoint range.

7.4.1 Switching response of the K 2 limit-value contact:

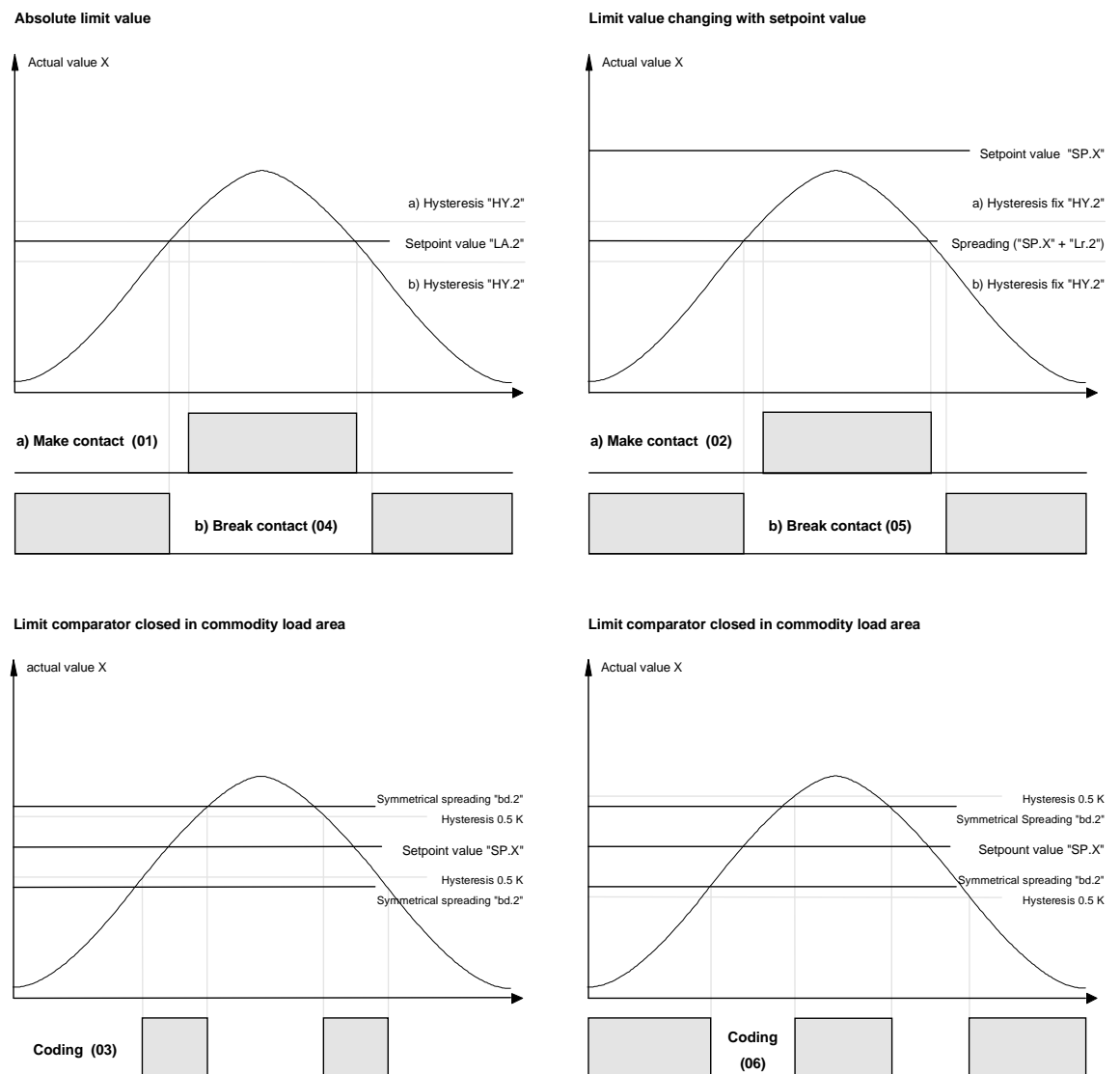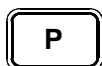Switching function relative to rising actual value

Absolute limit value

Limit value changing with setpoint value

Figure 5: Switching response of the K 2 limit-value contact

7.5 The parameterization level:

Setting control parameters:

P	Press for approx. 3 s	to get display:	**" Cod "**
			100
▲ **▼**	Enter code:		**55**
P	Confirm code:	Display:	**" PAr "**

| P | Jump to parameterization level.

Depending on the configuration of the outputs (configuration level) only those parameters are accessible which are needed for the specific function.

Display:	Parameter:	Range:	Factory setting:
"Pb.1"	Proportional band, control contact K 1 (Pb = 0.1...200% relative to setpoint range according to sensor ID, Section 2.1)	0.1...200% "Co.1" = 02, **05**	**5.0%**
"ti.1 "	Reset time, control output K 1 (adjustment zero = time 0)	0...999 s "Co.1" = 02, **05**	**250 s**
"td.1"	Derivative action time, control output K 1 (adjustment zero = time 0)	0...500 s "Co.1" = 02, **05**	**50 s**
"CY.1"	Cycle time, control output K 1	1...200 s "Co.1" = 02, **05**	**30 s**
"HY.1"	Hysteresis, control output K 1	0.1...5% of setpoint range limit dependent on sensor ID "Co.1" = 01, 04	1.0 K
"bd.1"	Symmetrical spreading, limit comparator K 1 (hysteresis fix at 0.5 K)	0.1...99.9 K "Co.1" = 03, 06	5.0 K
"LA.2"	Absolute setpoint, limit-value contact K 2	max. display range dependent on sensor ID "Co.2" = 01, 04	0.0 °C
"Lr.2"	Spreading, limit-value contact K 2 traveling with setpoint	-99...99.9 K "Co.2" = 02, 05	0.0 K
"bd.2"	Symmetrical spreading, limit comparator K 2 (hysteresis fix at 0.5 K)	0.1...99.9 K "Co.2" = 03, 06	5.0 K
"HY.2"	Hysteresis, limit contact K 2	0.1...20% of setpoint range limit dependent on sensor ID "Co.2" = 01, 02, 04, 05	1.0 K

7.6 The self-optimization level:

The DMP 96 A controller is equipped with an optimization routine for the automatic adaptation of the controller to the controlled system.

The optimization algorithm is based on modified Ziegler-Nicols rules, according to which the characteristic data of the system are calculated after an oscillation test in a closed-loop control circuit.

These characteristic data (particularly period and amplitude of oscillation) form the basis for calculating specific parameters.

Depending on the control function (heating controller or cooling controller), parameters are calculated for either the heating or the cooling side.

Starting and aborting optimization:

Optimization can be started or aborted on the self-optimization level (only when function is released).

Optimization optimizes for heating or cooling (heating controller or cooling controller, depending on configuration).

| P | Press for approx. 3 s | to get display: | **" Cod "** |
| | | | **100** |

| ▲   ▼ | Enter code: | | **111** |

| P | Confirm code: | Display: | **" tun "** |

| P | Jump to self-optimization level. | | |

Display:	Parameter:	Range:	Factory setting:
"HLP"	Correcting setpoint (see formula) 70...100 % for heating 100...130 % for cooling	70...130 %	90 %
"Opt" "on"	▲ **Start** self-optimization P Confirm		"OFF"
"Opt" "OFF"	▼ **Abort** self-optimization P Confirm		

For optimization the algorithm uses a correcting setpoint which is spread by the value set for the setpoint (parameter "HLP").
This correcting setpoint prevents temperature peaks occurring above the setpoint during optimization from damaging the controlled commodity. The optimization difference must be adjusted to the specific application.

$$\text{Corr. setpoint } (^\circ C) = \frac{\text{Setpoint } (^\circ C) \cdot \text{Parameter "HLP" } (\%)}{100\ (\%)}$$

During the optimization process the controller works with a P-regulating characteristic curve (Pb = 0,1%). Setpoint (correcting setpoint) / "OPt" are appear alternately on the display as a visual check.

To calculate parameters the controller requires two oscillations, after which it brings the control variable in line with the setpoint.

After completion of the optimization process only the current setpoint appears in the lower display. The calculated parameters are stored in the power-outage-proof EE-PROM, from where they can be retrieved at any time and modified manually.

Self-optimization is aborted during any interruption of power supply.

<u>**Example of heating optimization**</u>
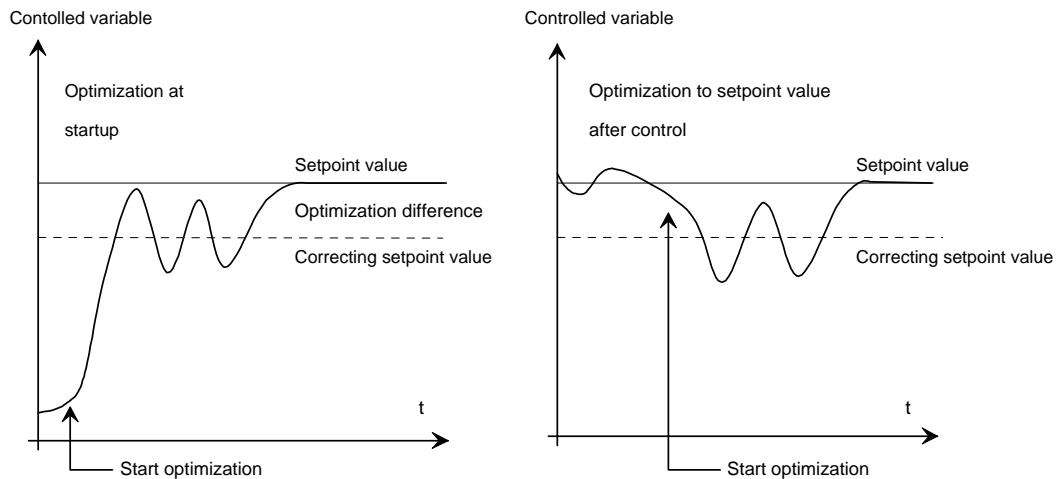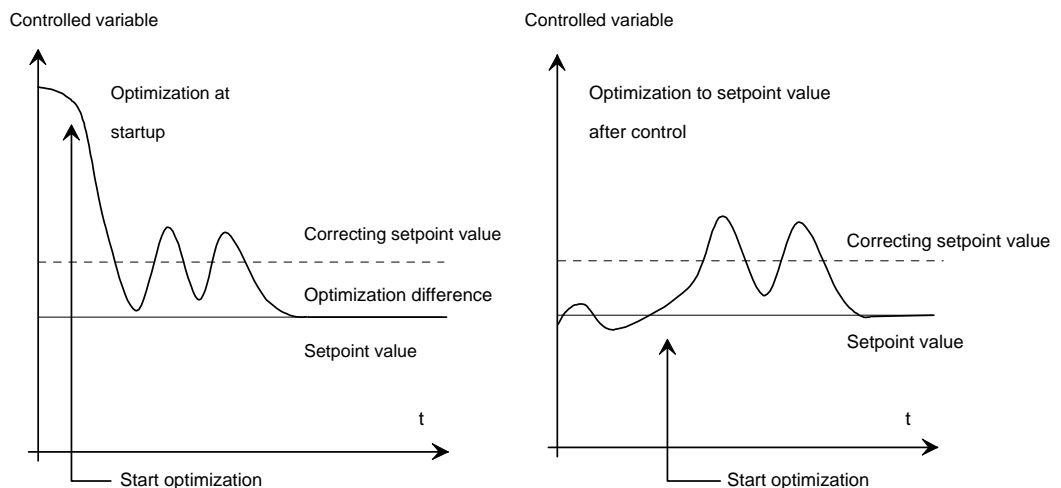

<u>**Example of cooling optimization**</u>

Figure 6: Self-optimization examples

7.6.1 Monitoring the optimization process:

The diagrams show possible incorrect settings with suggestions as to how to correct them.
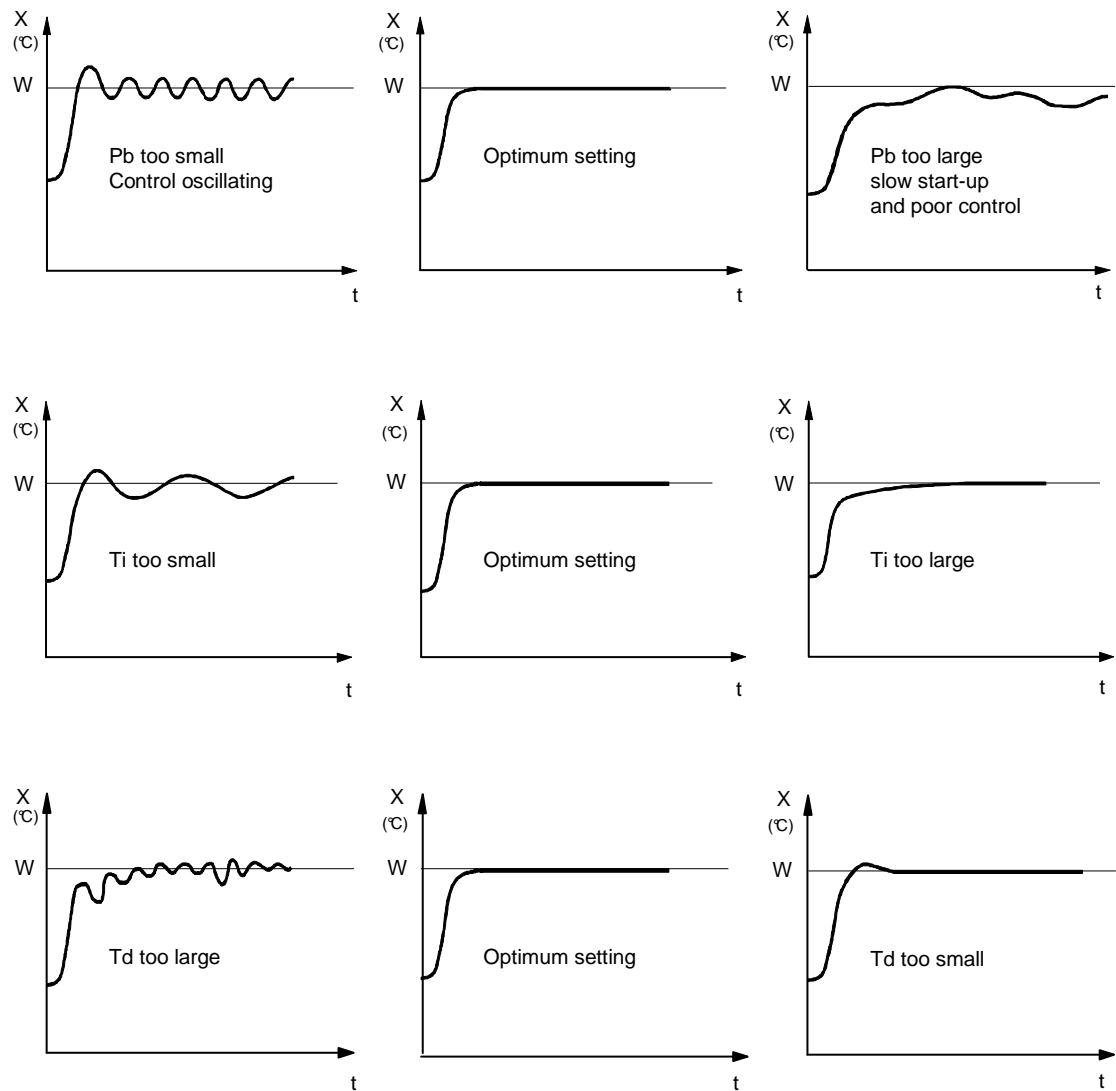
Figure 7: Incorrect settings of the feedback parameters

7.7   The information level:

P	Press for approx. 3 s	to get display: **" Cod "**
		100
P	Display:	**" inF "**
P	Jump to information level	

Display:	Parameter:
"Pnr"	Current program number

Display:	Parameter:
"SEn"	Sensor ID as in table

Sensor ID:

Sensor ID:	ID by ordering key:	Sensor:	Max. display range:	Max. setpoint range:	Display:
P 1	P 1	Pt 100	-69...149℃	-50...100℃	3 digits
P 2	P 2	Pt 100	-69...249℃	-50...200℃	3 digits
P 3	P 3	Pt 100	-69...349℃	-50...300℃	3 digits
P 4	P 4	Pt 100	-69...699℃	-50...600℃	3 digits
P 5	P 5	Pt 100	-169...149℃	-150...100℃	4 digits
tL1	L 1	Fe-CuNi Type L	-24...499℃	0...450℃	3 digi ts
tL2	L 2	Fe-CuNi Type L	-24...899℃	0...850℃	3 digi ts
tn1	K 1	Ni Cr-Ni Type K	-24...649℃	0...600℃	3 dig its
tn2	K 2	Ni Cr-Ni Type K	-24...1299℃	0...1200℃	4 d igits

8.   Line compensation, zero-point offset:

8.1   Line compensation:

Line compensation is required only with resistance thermometers in two-wire technology. Line resistance can be counterbalanced with the "Cor" parameter (configuration level).

Proceed as follows to generate line compensation:

1.   Connect a 100 Ω resistor to the end of the sensor line (corresponds to 0℃).
2.   Read off the actual value from the display.
3.   Jump to the configuration level.
4.   Correct line resistance (display in ℃) with the "Cor" parameter.

Example: 1.   Displayed actual value: +3.0℃
           2.   "Cor" value to be set on the configuration level: -3.0℃
           3.   Confirm the set value with the P key.
               Return to operating mode
           4.   Display of actual value: 0.0℃
           5.   Remove 100 Ω resistor from end of line.

8.2   Zero-point offset:

The "Cor" parameter can also be used for zero-point offset (offset value) towards plus or minus (as in the above example).

9.   Error messages:

9.1   Error messages (display):

Error display:	Cause:		Remedy / Explanation:
Er. 1	Pt 100 input:	Sensor short circuit or Lower range limit exceeded, Sensor breakage or Upper range limit exceeded.	Check sensor
Er. 1	Thermal converter input:	Sensor breakage or Upper range limit exceeded, Sensor poles reversed or Upper range limit, exceeded Ambient temperature of controller > 70°C.	Check sensor Check ambient temperature of controller
Er. 9	System error		Switch unit off/on

10. Program version:

Current program version:

0   20   H0

factory number

current program number

unit-specific number
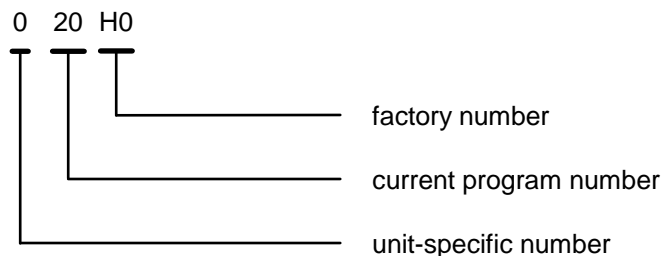
- Version 020:   Status: 19.02.96   Basic version: Single-channel controller (two-point controller, continuous-action controller) with analog output and logic input.

11. Immunity:

The immunity of the unit was tested with the following interference simulators manufactured by the Schaffner Company (Switzerland).

- NSG 222A: Interference pulses with broadband spectrum, short build-up time and low energy

Test values:	pulse amplitude	± 2500 V
	Rise time:	5 ns
	Symmetrical and asymmetric feed	

- NSG 225A: Interference pulse package with broad interference spectrum

Test values:	Stage 3:	2000 V
	Repetition frequency:	5 kHz

- NSG 203A: Testing after power outages

Test values:	at 100% supply voltage dip:	50 ms
	Repetition frequency:	1 Hz.